2.0 DESCRIPTION OF PROGRAM ALTERNATIVES

Section 2 describes the Program Alternatives that, individually or in combination, would achieve the Program's objectives of final disposition of the 4H shell mounds and remnant Platform Hazel caissons. These Program Alternatives are (see Table 1-1):

1. dredging of the shell mound materials and removal of the Hazel caissons with transport of the materials and caissons to one or more approved sites for disposal (e.g., at the LA-2 ocean disposal site offshore San Pedro and/or onshore);
2. in-place leveling of the shell mounds by spreading the materials over the sea floor, with removal, transport, and disposal of the Hazel caissons;
3. in-place capping of all shell mounds and the Hazel caissons;
4. in-place augmentation of all shell mounds and the Hazel caissons as artificial reefs;
5. augmentation of the Hazel caissons with an artificial reef after dredging or leveling the Hazel shell mound (an alternative to caisson removal in Program Alternatives 1 and 2);
6. leaving the shell mounds and caissons in place but providing offsite mitigation measures for the impacts on fishing and other resources.
7. the No Project Alternative, which would also leave the shell mounds and caissons in place without mitigation.

Section 2.1 identifies potential components of each Program Alternative, and provides a brief overview of the purpose, design and feasibility of each action. Sections 2.2 through 2.7 describe the Program Alternatives and identify regulatory approvals that may be required (see also Table 1-3). Potential significant impacts associated with each Program Alternative, and any mitigation measures to reduce adverse impacts, are discussed in Section 3.

2.1 SCREENING OF ALTERNATIVE METHODOLOGIES

Each Program Alternative consists of one or more of the following distinct components, actions, or methodologies:

1. removal of shell mound materials at one or more platforms;
2. removal of remaining platform caissons (Hazel only);
3. disposal of removed materials;
4. in-place modification options such as leveling and spreading, capping, and artificial reef augmentation at one or more sites;
5. offsite mitigation of fishing conflicts.

2.1.1 Shell Mound Material Removal Methods

The shell mounds, not including the Hazel caissons, are comprised of approximately 45,000 cubic yards (cy) of weakly consolidated sediments, cuttings, shells, and debris (e.g., pieces of concrete). As discussed in Appendix C, the chemistry of the shell mound materials differs from natural sediments, as the shell mounds contain metals, petroleum-derived hydrocarbons, PCBs, and other contaminants. Thus the design of a feasible shell mound removal methodology involves the application of dredging technology that:

1. can efficiently accomplish the removal of the shell mound materials with minimum incidental losses of the materials during the removal operation;
2. is feasible and effective at the 96- to 137-foot (29 to 42 m) water depths of the mounds;
3. is compatible with the physical composition of the shell mounds; and
4. can ensure completion within designated environmental windows.

As discussed in the NOP (CSLC 2002), de Wit (2001) reviewed historical applications, depth limitations, and the physical characteristics of the shell mound materials to determine the capabilities of various types of dredging equipment to remove the mounds (Table 2-1; see also USACE [1983] and USEPA [1994]). Potential removal techniques can be classified as follows: hydraulic dredges, open mechanical systems, clamshell bucket dredges, and other methods.

2.1.1.1 Hydraulic Suction Dredges

Hydraulic dredges, including bucket wheel or cutterhead suction dredges, are commonly used to remove large volumes of uniform (i.e., of similar composition and consistency) sediments within navigation channels. These operations typically produce a slurry, comprised of 80 to 90 percent water, which is pumped to an upland site for dewatering. The use of hydraulic suction is not practical at the shell mound sites because of the varying composition and consistency of the shell mounds materials and the 100-plus-foot (30m) water depths found at each site. In addition, due to the distance of the mounds from shore, the dredge slurry could not be pumped directly to an upland facility; a large volume of water from the dredge slurry would need to be contained in disposal scows onsite and possibly filtered or decontaminated. This would result in a lengthy removal period and large amounts of air emissions associated with dredging equipment and transport tugs to move the scows. Consequently, hydraulic dredges are not feasible for shell mound material removal work and their use is, therefore, not considered for further analysis in this Program EIR/EA.

2.1.1.2 Open Mechanical Dredging Systems

Open mechanical dredging systems such as bucket ladder, dipper, and dragline dredges can handle materials that are hard or of irregular consistency, but they generate large amounts of resuspended material, making them generally unsuitable for

Table 2-1. Comparison of Shell Mound Removal Techniques

Method	*Depth Limits*	*Typical Use*	*Advantages*[1]	*Disadvantages*[1]	*Feasibility*
Mechanical Dragline Dredge	Vessel and winch capabilities.	Deep-sea mining, construction.	T=Simple operation. Low relative cost.	T=Lack of precision. E=Spreads material over larger area. Potential for resuspension of fine sediments and contaminants.	Fair
Suction Hopper[2]	To 150 ft (45 m)	Sand and gravel mining.	T=Drag head variations. E=Reduced sediment resuspension during dredging.	T=Used in unconsolidated deposits, untested for shell mound material. Lack of precision. E=Large slurry volume requiring discharge, with loss of material, soluble components.	Poor
Clamshell Bucket[2]	Vessel and winch capabilities.	Offshore mining.	T=Simple operation, versatility. Relatively low cost.	T=Lack of precision, seastate-limited. E=Loss of some material during recovery to surface (sealed bucket minimizes losses).	Good
Bucket Ladder[2]	To 65 ft (20 m)	Soft sediments to hard rock deposits.	T=Can remove large, irregularly shaped material.	T=Depth limited. E=Resuspension of sediments.	Not feasible
Bucket Wheel Suction[2]	None found.	Unconsolidated deposits.	T=Good digging power. E=Less resuspension of sediments.	T=Potential high cost. E=Water discharge from recovered material.	Good
Stationary Suction[2]	650 ft (200 m)	Unconsolidated deposits.	T=Removing sand and gravel deposits. Deep-water capability. E=Less resuspension of sediments.	T=Untested for shell mound material. E=Water discharge from recovered material.	Marginal due to unknown lift capability.
Cutterhead Suction[2]	To 100 ft (30 m)	Compacted and granular deposits.	T=Removing sand and gravel deposits. E=Less resuspension of sediments.	T=Depth limited. Untested for shell mound material. E=Substantial water discharge from recovered material.	Marginal due to unknown lift capability.
Submersible Systems	None found.	Unconsolidated deposits and oilfield debris.	T=Positioning accuracy. E=Limited resuspension of sediments at cutter head.	T=Potential high cost. E=Tracked equipment could leave temporary trenches around the site. Water discharge from recovered material.	Poor
Continuous Line Bucket[2]	Shallow water (mostly coastal/inshore).	Shallow deposits.	T=Limited digging power.	T=Limited number of operational systems available.	Poor
Gorilla Net	Limited only by vessel and winch capability.	Oilfield debris.	T=Simple operation. Relatively low cost.	T=Lack of precision. E= Spread material over larger area. Seafloor scars around the feature. Resuspension of sediments.	Fair

Source: de Wit 2001
[1] E = environmental, T = technical [2] These methods may require anchoring, thus temporary seafloor scars could result.

dredging contaminated sediments (USEPA 1994). Heavy-duty trawl or “gorilla” nets have similar limitations and are also not intended to remove contaminated sediments.

Consequently, these types of dredges cannot feasibly remove the bulk of the shell mound materials and their use is, therefore, not considered for further analysis.

Heavy-duty trawl nets are, however, suited to the removal of debris, and have been used for that purpose in post-abandonment cleanup activities in Gulf of Mexico oilfields. The nets could be deployed toward the end of the shell mound removal operations to remove coarse sediments and debris, and to level the sea floor at each site.

2.1.1.3 Clamshell Bucket Dredges

Clamshell bucket dredges, operated by derrick from stationary barges, are relatively versatile and economic systems for dredging materials of varying consistency, and they can work at the depths of the shell mounds. These types of dredges “bite” into the sediments and are hoisted to the surface with only small amounts of water, resulting in reduced volumes of decant water and increased dredging efficiency. A drawback of conventional clamshell bucket dredges is that considerable spillage of dredged material and release of any associated contaminants can occur while the bucket is being raised. This problem is remedied through the use of enclosed or sealed clamshell buckets. The efficacy of these types of buckets in reducing sediment resuspension volumes has been demonstrated, and they are widely used to remove contaminated sediments in dredging operations (USACE 1983, 1986, 1999, 2001; USEPA 1994).

Dredged materials brought to the surface by clamshell dredging are expected to be moderately consolidated (about 50 percent solids). Nevertheless, excess water should be decanted prior to transport in order to reduce the time, costs, and operational impacts associated with transporting a greater volume of material. If the materials are to be disposed of onshore, they may need to be dewatered prior to transfer at the onshore off-loading location. Subject to permit approvals and approved final destination for the materials (to be determined), the dredged materials could be loaded into and transported on open or covered barges or loaded into sealed containers for transport to the off-loading location. Split-hull disposal barges would be used in the event of ocean disposal.

2.1.1.4 Other Methods

A methodology not reviewed by de Wit (2001) involves the use of relatively portable, submersible pump systems that operate by air or water displacement to create suction and lift sediments. These systems are typically operated by cables, with divers assisting, and can be positioned precisely to remove sediments in narrow confines. The systems, however, are not designed for large-scale removal of unconsolidated materials such as those found at the shell mound sites. Like suction dredges, they also pump dredged material in a slurry, require additional capacity at the surface to handle the decant water, and would result in a lengthy removal period and additional air emissions.

Consequently, they alone are not a feasible method. Submersible pump systems could, however, be used to complete the removal of sediment in and around the Hazel caissons and near to any other large structures or debris where a conventional dredge cannot be operated.

2.1.1.5 Conclusion

In conclusion, removal of the shell mounds materials would most feasibly be achieved with the use of:

1. an enclosed clamshell bucket dredge to remove most of the material with dewatering occurring at the surface prior to transport via barge and/or at an onshore disposal site;
2. one or more relatively portable air- or water-lift pumps to achieve precision removal of sediments around caissons or large debris where conventional dredging equipment cannot be operated; and
3. heavy-duty trawl or gorilla nets at the final stage of the operation to remove small debris and recontour the seafloor.

2.1.2 Removal of Remaining Platform Structures (Hazel Caissons)

Removal of the Hazel caissons is a distinct component because the caissons cannot be dredged along with the shell mound materials. The design of a removal strategy requires careful consideration of the makeup of the caissons, as well as the likely effectiveness and environmental impacts of the different removal methods.

2.1.2.1 Description of Caissons

The four remnant Hazel caissons are each approximately 40 feet (12 m) high and 27 feet (8 m) in diameter. The caissons were designed to float the jacket of the platform into place. The base of each caisson was ballasted with 180,000 lbs of sand to provide stability while under tow. Once over the site, the caissons were flooded, allowing the jacket structure to settle in place. The caissons incorporated several features to secure the jacket to the sea floor (Standard Oil Co. of California [Standard; later Chevron] 1957). The center of each caisson was fitted with hollow pipes inside the main piling. One pipe had a swiveling jet nozzle to loosen seafloor sediments with high-pressure water. Next to this was a larger pipe that was used as an air lift to displace water and sediment upwards inside the larger pipe. Each caisson also had 12 low-pressure jets around its steel lining which could be used to reduce friction as the caisson settled. The excavation assembly was contained in a domed chamber at the caisson base. The four caissons were engineered to excavate the structure to its design depth approximately 22 feet (7 m) beneath the seafloor sediments, where it would rest on the firm shale substratum with 18 feet (5.7 m) protruding above the sea floor (Figures 2-1 and 2-2).

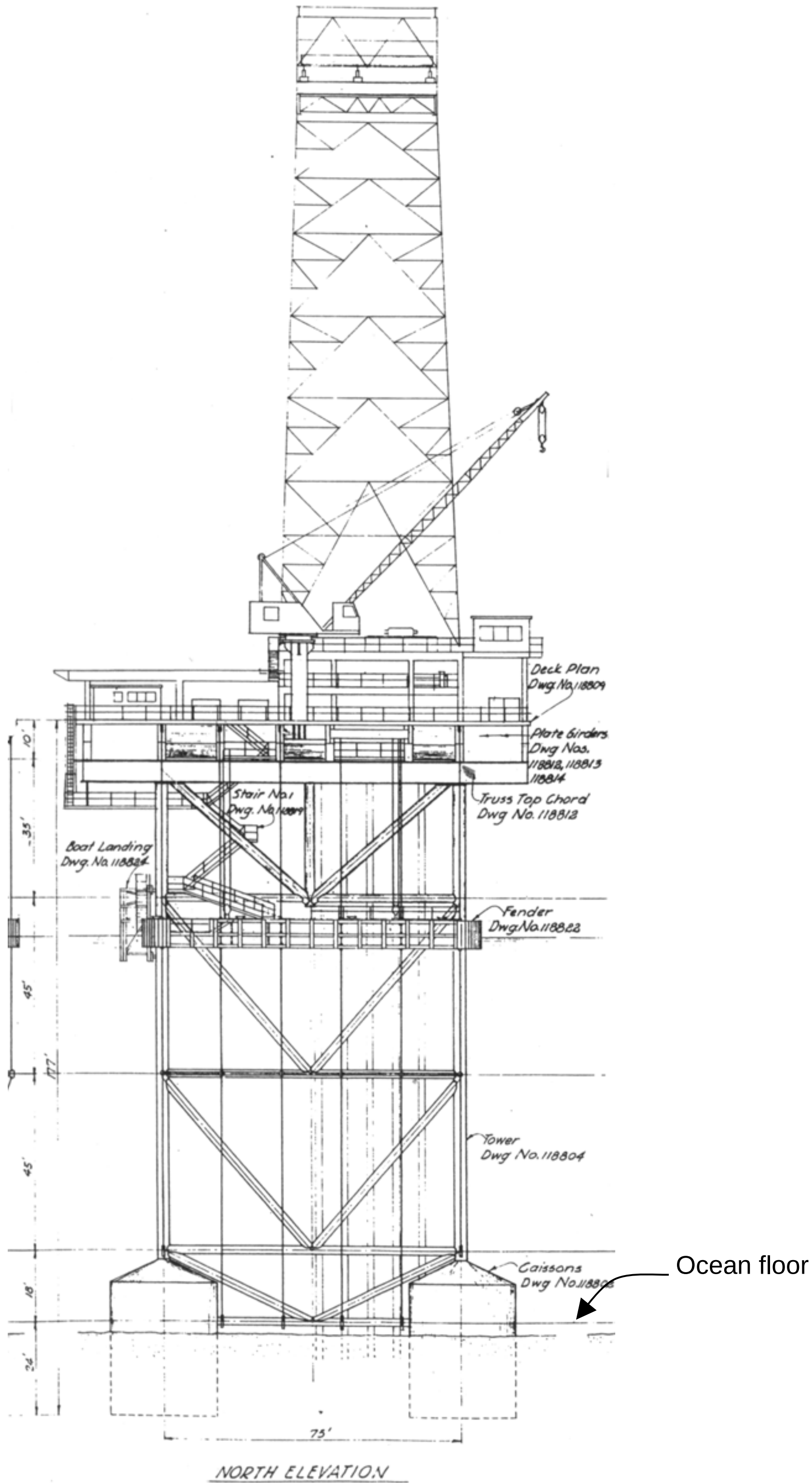

Figure 2-1. Platform Hazel

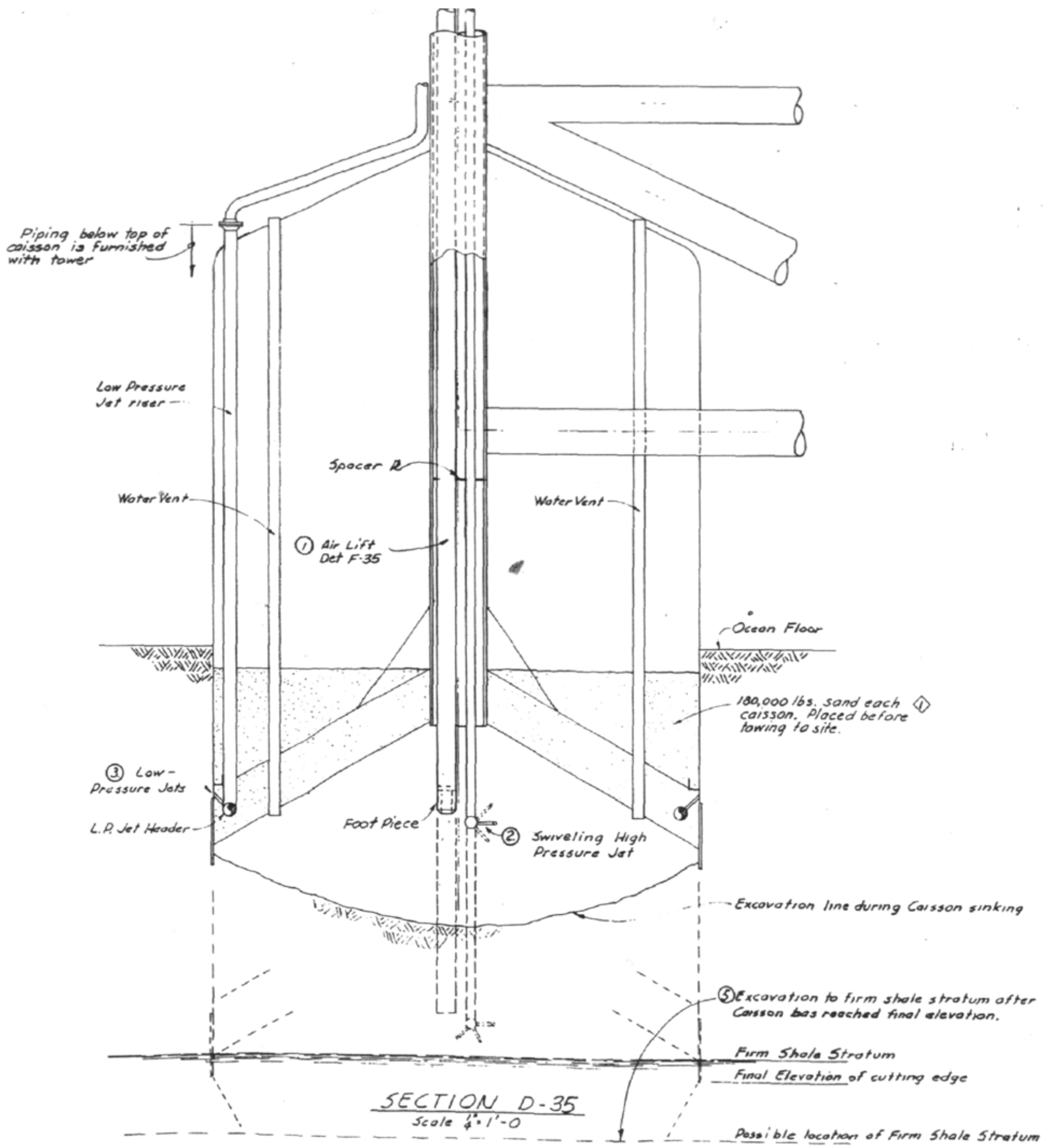

Figure 2-2. Cross-section of Platform Hazel Caisson Showing Excavation Chamber

Once the caissons were buried to design depth, a reinforcing cage was lowered into the hollow main piling of each caisson, then the cutting chamber and piling were filled with concrete. Next, the caisson was filled with sand to the level of the sea floor. After this, a 5-foot (1.5 m) layer of concrete was added, then the caisson was filled as closely as possible to the top with sand. Over the years, mussel shells, sediments, drill cuttings, and drill muds buried the caissons. When Platform Hazel was removed, the concrete-filled main pilings were cut off, leaving the caissons buried and presumably intact. The stub of one piling extends several feet above the shell mound material.